

On the Terminal Growth of Phanerogams.

From the present standpoint of science taken in connection with the writer's own observations, the following propositions may be deduced.

(1). The theory of Huxley, which is almost universally accepted at the present time, that the apical growth of Phanerogams does not proceed from a single point (Scheitelzelle) but is the result of the independent development of three different tissues is not proved by any of the hitherto known facts. The investigations are ^{not sufficient} ~~too inaccurate~~, they do not take sufficiently into account the difficulties which solid organs, as contrasted with those formed of a single layer of cells, offer, and they leave the possibility of the presence of a single terminal cell out of consideration. The explanations which can be gained from ~~fairly~~ ^{fairly} streaks in the tissues are arbitrary and often contradic-

more
accurate

the, tracheids. Also in some of the vascular cryptogams, the apex of the stem of the very same plant sometimes ~~also~~ exhibits an appearance such as is seen in the apex of Phanerogams and sometimes an undoubted ~~in~~ terminal cell. (*Zelazniella ciliata*.)

There are not a few facts which are directly irreconcilable with the prevailing theory of growth. Plerom and Periblem ~~are~~ in many cases not distinct near the apex; this is most striking in thin leaves where both tissues arise from a single layer of cells. Further, Periblem and Dermatogen are at times not distinct near the apex since cells of both systems have proceeded from one mother cell. Finally there are ~~young stages~~ ^{young stages} of leaves which do not commence with a swelling of the Dermatogen but where the ~~the~~ incipient projection shows an ~~an~~ arrangement of cells like that of the vascular cryptogams. (*Elodea*.)

3. The prevailing ~~view~~ theory of growth can on phylogenetic grounds be declared

impossible. The slow of Phanerogams is the ~~descent~~ of forming of that of the vascular cryptogams; the apical growth of Phanerogams is the continuation of the growth by means of a single cell. The metamorphosis of the latter into the Plerom-Periblem-Dermatogen growth is, from the experience of our narrative morphology, inconceivable. This experience was either too little known or too little considered in the adoption of the theory of descent up to the present time and on general grounds scarcely touches the distinct causal forces of the cell division.

4. The formation of the embryo of Phanerogams is no proof of the prevailing theory of growth, at all events, as a rule, the embryo possesses no ~~terminal~~ apical cell and certainly none which would become the apical cell of the stem. But furthermore this is not the case with the vascular cryptogam and only a forced and absolute interpretation could derive about such a change. The embryo of the vascular cryptogams has at the apex

two (sometimes four) cells which are similar
in shape and in position, from one of which
the primary apical cell of the stem is cut off.
5. The ~~center~~ ^{and phloem} of the vascular cryptogam is
not a Cambium but a Thalloid like the moss
& sporangium from which it is phyllo-entically
derived. The cotyledons are not Phylloclada
but Thalloclada. The stem arises as a
new ^{structure} formation on the embryo.

6. The ~~stem~~ apical growth of Phanerogams has
not yet been ^{quite} clearly observed only in a few
roots (Eleocharis, Vallisneria, also in Callitriche,
Alisma, Myriophyllum). The apical cell
appears four-sided in longitudinal section, seen
from above generally three ^{angled} sided. Segments are
then cut off by partitions which run tangentially
and in them there arises first an ~~epidermal~~ ^{epidermal}
wall, and the remaining wall by which the bark
cells are formed follow one another preferably
from without inward. By partitions in the apical
cells, cells are cut off at its base from which
cells the vascular axis arises. The root-cap grows later
preferably in division of the cells lying next to
the apical cell. The epidermis remains undivided
(Callitriche, Eleocharis) or divides into two layers of Vallisneria
(Myriophyllum). — The analogy leads us to suppose that the apical

the stem may show another type of growth